TABLE 3.—*Probable numbers of days in 10 years with certain minimum temperatures, or lower, at certain stations in the Santa Clara Valley, Calif., during certain periods in spring*

Stations and periods	Probable numbers of times in 10 years the following temperatures will be equaled or exceeded										
	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°
Berryessa:											
First half March			1	3	7	12	18	24	31	39	49
Second half March				1	2	5	9	14	20	26	32
First half April					1	3	5	9	15	21	27
Second half April					1	2	4	6	9	12	17
First half May								1	2	6	11
Toyon Avenue:											
First half March						1	3	7	12	18	24
Second half March							1	2	5	10	15
First half April								1	3	5	9
Second half April								1	2	4	6
First half May											1
Evergreen:											
First half March			1	4	8	13	19	26	33	41	51
Second half March				1	3	6	10	15	21	27	33
First half April					1	3	6	10	16	22	29
Second half April					1	2	4	6	9	13	19
First half May								1	3	7	12
McKinley:											
First half March		1	3	7	12	18	24	33	42	54	69
Second half March			1	2	5	9	15	21	28	35	49
First half April				1	3	5	9	16	23	31	42
Second half April				1	2	4	6	9	14	21	35
First half May							1	3	7	15	27
Oak Grove:											
First half March			1	5	11	17	24	32	40	49	58
Second half March				1	4	9	14	20	26	32	39
First half April					2	5	9	15	21	27	34
Second half April					2	4	6	9	12	17	24
First half May							1	2	6	11	18
Valley View and Hamilton Avenue:											
First half March			1	3	8	14	22	31	41	52	64
Second half March				1	3	7	12	19	27	35	45
First half April					1	3	7	14	22	30	39
Second half April					1	2	5	9	13	20	30
First half May							1	2	6	14	23
Willow Glen:											
First half March	1	3	7	14	22	31	43	55	69	79	89
Second half March		1	2	7	12	20	28	36	49	65	78
First half April			1	3	7	15	23	32	42	52	62
Second half April			1	2	5	9	14	21	36	47	57
First half May					1	2	7	15	27	36	48
Winchester (1922) and Prune Ridge (1923):											
First half March			1	5	10	15	22	30	39	49	58
Second half March				1	4	8	12	19	26	32	39
First half April					2	4	7	14	21	27	34
Second half April					1	3	5	8	12	17	24
First half May							1	3	6	11	18
Moreland:											
First half March			1	5	10	17	24	31	39	49	58
Second half March				1	4	9	14	20	25	32	39
First half April					2	5	9	15	21	27	34
Second half April					1	4	6	9	12	17	24
First half May							1	2	6	11	18
Cupertino:											
First half March						1	4	10	17	24	31
Second half March							1	4	9	14	20
First half April								2	5	9	15
Second half April								1	4	6	9
First half May										1	2
Loyola:											
First half March							2	6	11	17	24
Second half March								2	4	9	14
First half April								1	2	5	9
Second half April									2	4	6
First half May											1
Sunnyvale:											
First half March			1	3	7	11	18	27	36	49	62
Second half March					2	5	10	17	24	32	43
First half April					1	3	5	11	18	27	37
Second half April					1	2	4	6	11	17	29
First half May								1	4	11	21
Pomeroy:											
First half March			2	5	11	17	24	32	43	56	69
Second half March				2	4	9	14	20	28	36	49
First half April					2	5	9	15	23	32	42
Second half April					2	4	6	9	14	21	35
First half May							1	2	7	15	27
Midway (1922 only):											
1st half March				1	3	7	12	18	24	32	39
Second half March					1	2	5	9	14	20	25
First half April						1	2	5	9	15	21
Second half April							2	4	6	9	12
First half May									1	2	6
Mountain View Junction (1923 only):											
First half March		1	4	10	17	24	31	39	48	58	69
Second half March			1	4	9	14	20	26	32	39	50
First half April				2	5	9	15	21	27	34	42
Second half April				1	4	6	9	12	17	25	35
First half May						1	2	6	11	18	27
Vasona Junction (1923 only):											
First half March					1	3	7	12	18	24	31
Second half March						1	2	5	9	14	20
First half April							1	3	5	9	15
Second half April								2	4	6	9
First half May										1	2

TABLE 3.—*Probable numbers of days in 10 years with certain minimum temperatures, or lower, at certain stations in the Santa Clara Valley, Calif., during certain periods in spring*—Continued

Stations and periods	Probable numbers of times in 10 years the following temperatures will be equaled or exceeded										
	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°
Pioneer (1923 only):											
First half March			1	3	7	12	19	27	36	48	60
Second half March				1	2	5	10	17	23	32	41
First half April					1	3	6	11	18	27	36
Second half April					1	2	4	7	11	17	26
First half May								1	4	11	20
South Coyote (1923 only):											
First half March				1	3	7	14	22	31	43	55
Second half March					1	2	6	13	20	28	36
First half April						1	3	7	15	23	31
Second half April						1	2	5	9	14	21
First half May									2	7	15
Joseph Ranch (March 1923 only):											
First half March											1
Second half March											0
Santa Clara:											
First half March				1	3	7	12	18	24	31	39
Second half March					1	2	5	9	14	20	26
First half April						1	3	5	9	15	21
Second half April						1	2	4	6	9	12
First half May									1	2	6
Mountain View (decided fruit station):											
First half March				1	3	7	13	20	28	38	49
Second half March					1	2	6	11	18	25	32
First half April						1	3	6	12	19	27
Second half April						1	2	4	7	11	17
First half May									1	5	11
Los Gatos:											
First half March									1	3	7
Second half March										1	2
First half April											1
Second half April											1
First half May											0

634.9.43 : 551 : 515

FOREST FIRES AND STORM MOVEMENT[1]

By E. F. McCARTHY, Silviculturist

[Appalachian Forest Experiment Station, U. S. Forest Service]

A study of weather in relation to forest-fire hazard was carried on during the usual fire season from October 15 to November 30, 1923. Weather data were obtained from the United States Weather Bureau station at Asheville, N. C., and fire records from the national forests of western North Carolina and eastern Tennessee, and from the district fire warden for the mountain district of North Carolina.

While the purpose was to determine the feasibility of predicting periods of fire hazard two or more days in advance, the data collected have made possible the comparison of the current season with the fall season of 1922, for which records were obtained last year.[2]

In the fall of 1922 a season of severe forest fire hazard was experienced throughout the Southern Appalachians from the last week in October to about the end of November. The fire season of 1923 was of much shorter duration and of medium severity for about 15 days. A detailed discussion of these two seasons will make clear the value of weather information as a factor in fire protection.

Before entering a discussion of weather it should be known that fall fires in this region are fed largely by leaf litter of the current year and only minor fires can occur until the leaves are down in quantity and dry enough to create fuel for a fire.

In 1922 a dry period through September and early October was followed, beginning October 5, by heavy

[1] Presented at the meeting of the Society of American Foresters, Baltimore, Md., Dec. 28, 1923.

[2] "Forest Fire Weather in the Southern Appalachians," MO. WEATHER REV., April, 1923, 51; 182-185.

rains. These continued frequently until October 23. About half of the leaf crop was down during the last week of October, which would have been the most severe fire period of the season had all the leaves been down and dry. Rains during November were very light and infrequent. The first seven days of November were days of high humidity and the falling leaf crop did not dry out seriously. No rains had packed this leaf litter, which was loose and deep. Beginning November 8, fires were practically continuous until November 27, except during three days of high humidity and light rainfall. From the 8th to the 15th and from the 20th to the 25th two periods of severe hazard resulted from the looseness of the litter and from weather conditions favorable to fire.

This first period of fire hazard began on November 8, when a storm centered over southern Ontario was passing eastward. This induced northwest winds with a rising barometer and fall in vapor pressure. These winds, coming from the interior of the continent and warming as they move southward, are usually low in humidity, a condition which is increased by the downward convection of cold air in the high pressure zone which warms as it approaches the surface. After the passing of this storm high pressure continued to the northwest of the mountains for two days and remained over the Appalachian Plateau until November 15, when it moved northeastward and gave place to a storm which had first appeared over Oregon on November 6. Rain on November 15 checked the fires. This period of dryness was due to a high-pressure zone which, after the usual approach from the northwest, remained over the Southern Appalachian region. The storm which brought relief on November 15, had moved from Oregon to Texas, then up the Mississippi Valley and out over lower Canada. It was followed by high pressure and dry weather for two days, which induced more fires. Another well-developed storm moved east from Montana, bringing south winds and a trace of rain on November 20, when the advance of a broad, flat zone of high pressure ushered in a severe period of seven days of fire.

This period was marked by continuous high pressure over and west of the Appalachians. One storm passed across the United States during this time, but the intervening high-pressure zone to the south prevented Gulf winds from affecting the Appalachian region. On November 26, due to lessened pressure in the Mississippi Valley, a low-pressure zone moved in from the region of Montana and brought a snowfall in the Appalachians. This effectively checked serious fires for the season, since storms became more frequent and soon took on the size and intensity of the winter type.

Before leaving the discussion of the 1922 fall season, it should be noted that the active fire season showed only one instance of barometric pressure below 30 inches (corrected to sea level)and that the temperature fell gradually throughout November, giving lower absolute humidity.

The active fall-fire season of 1923 covered about 15 days from November 9 to November 22, a period which was broken once by a light fall of snow. In contrast to the previous year, the fall of 1923 was dry until October 18, but from this time storms were frequent and irregular in movement throughout the season, except for the 15 days mentioned. The leaf crop came down slowly, some of it being whipped off by storms in a partially green state. The frequent rains previous to November 8 had compacted the litter and prevented its drying.

A severe drop in temperature followed two Gulf storms which swept the eastern States toward the end of October. The first traveled nearly due north from the Gulf to the Great Lakes and a second moved north along the Atlantic coast, thereby increasing the depression of temperature and causing a snowfall in a portion of the mountain region. This snowfall, due to the mechanical breaking off of green leaves and the low temperatures which followed, was favorable to fire prevention. A third Gulf storm brought precipitation and passed to the northeast on November 8. From then until November 22 the mountain region was under the influence of a high-pressure zone, but during the time one storm passed across the Lakes and caused a light precipitation without a marked fall in barometer. The dry period was finally broken by a storm which passed from the southwest to the region of the Great Lakes.

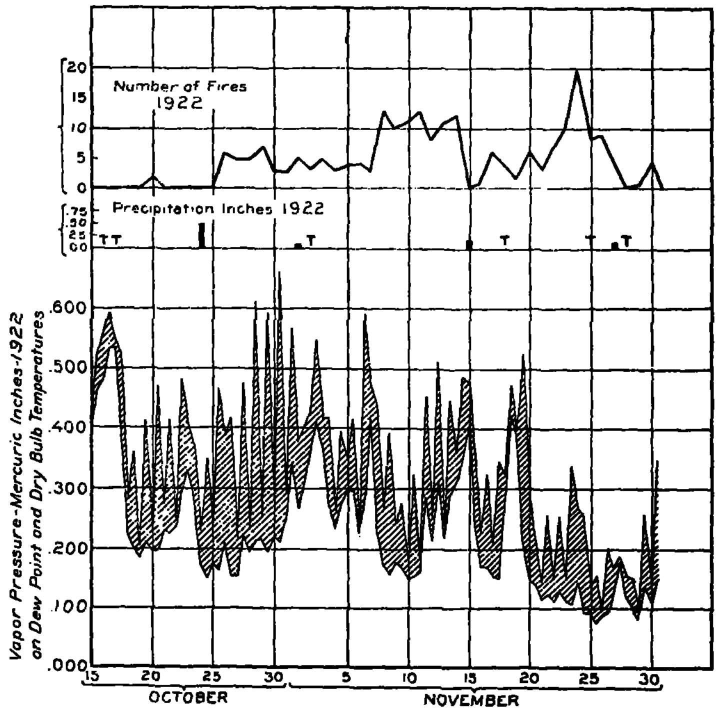

FIG. 1 - RELATION OF FIRES TO PRECIPITATION AND VAPOR PRESSURE, 1922

The entire period of six weeks during which fires usually occur was marked in 1923 by irregular movement of storms and by predominance of southern winds which brought moisture from the Gulf and Atlantic. During November there was an upward rather than downward trend of temperature and a generally lower range of barometer than in 1922.

In this brief record of storm movement during these two fall-fire seasons, periods of fire hazard are seen to coincide with instances of high pressure over the Mississippi Valley and Appalachian Plateau. During the average cycle of storm movement, in which storms appear successively at intervals of three to five days, the Appalachian region does not remain long enough under a high pressure zone to undergo the most severe type of fire hazard. From one to two days are needed to dissipate the moisture brought by a rain or snow storm. To produce very dry conditions, therefore, either a stagnation of storm movement must take place in such a way as to leave a high zone over the Appalachian region or there must be a continuation of high pressure accompanying the movement of storms across the country to the north. Instances of both kinds occurred during the two seasons reviewed.

The logical conclusions of the study of two fire seasons are summarized as follows:

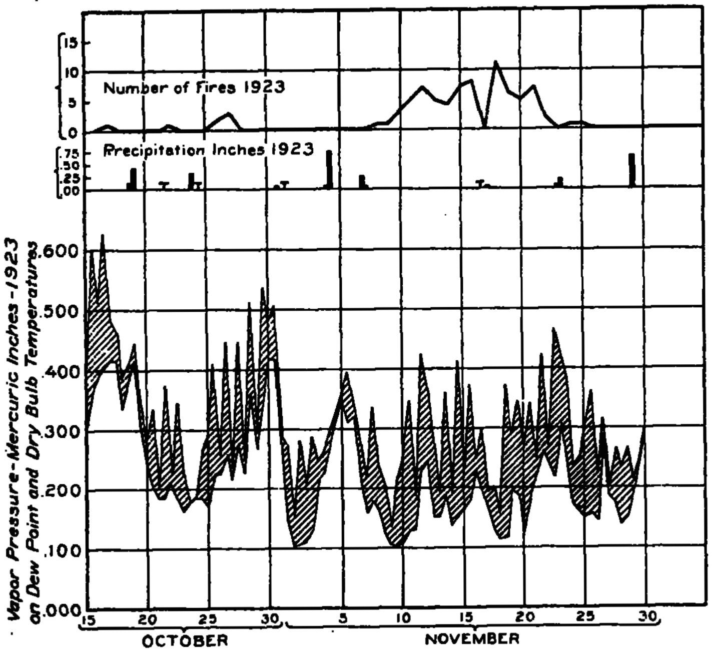

FIG. 2 - RELATION OF FIRES TO PRECIPITATION AND VAPOR PRESSURE, 1923

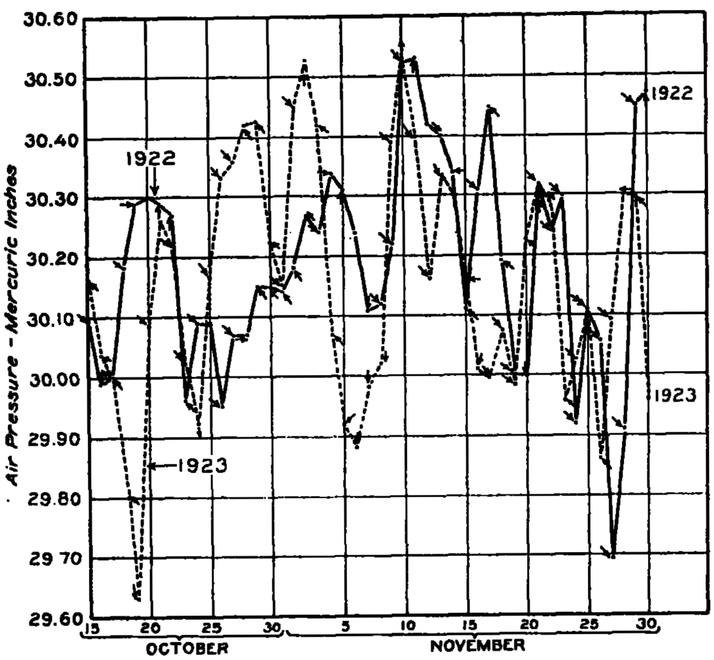

FIG. 3 - AIR PRESSURE IN 1922 AND 1923
(Arrows Indicate Wind direction)

1. Weather conditions are of minor importance until the leaf crop is down.
2. Heavy rains which pack the leaf litter retard its drying and make fire control easier.
3. Dry periods occur after the passing of storms and with the advent of high pressure. This induces winds from the interior of the continent, which are dry; it brings lower temperatures, clear days, and lower absolute humidity. Day temperatures are high in spite of heat lost by radiation at night. The large diurnal range of temperature makes relative humidity low at midday.
4. The Appalachian Plateau, by reason of its altitude and consequent radiation of heat, tends to induce a downward movement of air and retain high pressures.
5. Disturbances which displace the pressure conditions in times of severe fire hazard commonly advance over Montana or Texas and the Gulf. Storms of the latter type are less frequent in the late fire season.
6. The weather data collected daily by the Weather Bureau at Washington is broad enough to indicate such disturbances and the rate of movement with sufficient accuracy to forecast them at least three days in advance. This is not a marked departure from present Weather Bureau practice, since general weekly forecasts are now issued by this Bureau.

The undertaking of forecasts for the specific purpose of aiding in forest-fire control will further research in this line and result in a concerted effort to increase the usefulness of such a service. Studies of storm movement at times of great fire hazard as shown by fire records will furnish the experience needed to fix the paths of storms during the brief periods involved.

Field research should furnish a more accurate measure of successful prediction than chance fires by a study of the factors controlling leaf fall and the rate of drying of litter under varying conditions of the atmosphere.

634.9.43 : 551.594

LIGHTNING FIRE LOSSES[1]

By ROY N. COVERT, Meteorologist

As an introduction to the subject it is desired to state that while it is known that the Weather Bureau of necessity has carefully studied the thunderstorm and its phenomena both from the physical and climatic aspects, many do not realize that for more than 30 years this Bureau has been an earnest advocate of the protection of buildings and other property against lighting by suitable rodding. Amongst its literature will be found bulletins on protection appearing as early as 1894, and as an outgrowth, the Bureau is frequently called upon to advise inquirers concerning the proper methods and materials to be employed. Occasionally plans are drawn up in detail for the protection of Government structures, as for example the White House, which was rodded in 1910 after plans and specifications prepared by Professor Marvin.

The object of the study presented in this paper was to determine the relative liability of farm buildings to fire damage by lightning. This object has been reached only approximately and in part because of the nature and insufficiency of the available information, but there is enough of interest it is believed to merit consideration.

Following is a brief discussion of the data employed:

1. The annual lightning-fire losses by states for the years 1915 to 1922, both years inclusive, from which a yearly average was obtained, were furnished by the National Board of Fire Underwriters. These figures, given in dollars, represent all the losses reported by their Actuarial Bureau, and an additional 25 per cent estimated by them to cover unreported losses. Changes in value from year to year are taken into account in estimating losses.
2. The number of farms in each State reported in the 1920 census. A farm is defined as "all the land which is

[1] Presented before the American Meterological Society at its meeting in Washington, D. C., April 1924.